Journal of Pioneering Medical Sciences
Received: January 22, 2025 | Accepted: February 28, 2025 | Published: June 05, 2025
Volume 14, Issue 05, Pages 20-XX
DOI https://doi.org/10.47310/jpms2025140504

Knowledge and Preventive Practices Regarding Medication Toxicity Among the Saudi Arabian Population

Anas A. Alhur[1*], Fatimah Qaysi[2], Miad Alhomaidi[3], Mohamed Hashem[4], Hasna Alruqi[5], Bothinah M. AbuAlhasan[6], Muhannad Alqahtani[7], Jameelah Almutairi[8], Sarah Yahya[9], Manal Aljuaid[10], Hattan Aldadi1[1], Norah Saleh[12], Rawan Alfarra[13], Manar Alhujaili[14] and Abdullah Alharbi[15]

[1]Department of Health Informatics, College of Public Health and Health Informatics, University of Hail, 55476 Hail, Saudi Arabia
[2]College of Pharmacy, Princess Nourah Bint Abdulrahman University, Riyadh 11564, Saudi Arabia
[3]NH Private Hospital, Saudi Arabia
[4,11]College of Pharmacy, Umm Al-Qura University, Makkah 21955, Saudi Arabia
[5]Innova Pharmacy, Riyadh, Saudi Arabia
[6]College of Pharmacy, University of Tabuk, Tabuk 71491, Saudi Arabia
[7]College of Pharmacy, King Saud University, Riyadh 11451, Saudi Arabia
[8]Department of Toxicology and Regulatory Affairs, Pharma Pharmaceuticals, Riyadh, Saudi Arabia
[9,12]College of Pharmacy, King Khalid University, Abha 62529, Saudi Arabia
[10]College of Pharmacy, Taif University, Taif 26571, Saudi Arabia
[11]College of Pharmacy, Umm Al-Qura University, Makkah 21955, Saudi Arabia
[12]College of Pharmacy, King Khalid University, Abha 62529, Saudi Arabia
[13]Ibn Sina National College for Medical Studies, Jeddah 21418, Saudi Arabia
[14]Ministry of Health, Saudi Arabia
[15]College of Pharmacy, Qassim University, Buraydah 51452, Saudi Arabia

Author Designation: [1]Lecturer, [5]Clinical Pharmacist, [8]Regulatory Affairs Specialist

*Corresponding author: Anas A. Alhur (e-mail: anas.ali.alhur@gmail.com).

©2025 the Author(s). This is an open access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0

Abstract **Background:** Medication toxicity is a persistent public health issue globally and is frequently associated with inappropriate drug use, inadequate storage and unsupervised self-medication. In Saudi Arabia, while access to pharmaceuticals and healthcare services has improved, public awareness and engagement in safe medication practices remain suboptimal. This study addresses a gap in national data concerning knowledge and behaviors related to medication toxicity. **Objective:** To evaluate public knowledge, perceived risk factors and preventive practices regarding medication toxicity among the Saudi population and to examine associations with key demographic variables. **Methods:** A cross-sectional study was conducted using a structured and validated questionnaire distributed to 543 individuals across different regions of Saudi Arabia. The instrument assessed demographic characteristics, awareness of medication toxicity, risk perceptions, safety-related behaviors and professional consultation patterns. Data analysis was performed using IBM SPSS Statistics version 26. Chi-square tests determined associations between demographic factors and medication safety practices (significance set at $p<0.05$). **Results:** Although 86.2% of participants reported awareness of medication toxicity, preventive practices were inconsistently applied. Only 63.6% consistently checked medication expiry dates and 34.1% acknowledged storing medications in potentially harmful conditions. Additionally, 57.1% reported discontinuing medications upon experiencing side effects without seeking professional advice. Significant associations were identified between gender and awareness ($p<0.001$), education level and consultation behavior ($p<0.001$) and storage practices and awareness ($p<0.001$). **Conclusion:** The findings reveal a disconnect between awareness and behavior regarding medication safety. Demographic factors, particularly gender and educational attainment, significantly influence safety practices. These results underscore the need for targeted educational interventions, strengthened pharmacist-patient communication and community-based awareness programs to mitigate the risk of medication toxicity.

Key Words Medication toxicity, public awareness, drug safety, preventive practices, self-medication, Saudi Arabia

INTRODUCTION

The appropriate use of medications is essential for the prevention, management and treatment of numerous health conditions. However, when used improperly-whether through incorrect dosing, unsafe storage or unsupervised consumption-medications can become toxic and pose serious health risks, including organ failure, extended hospitalization and mortality [1]. Recognizing the severity

of this issue, the World Health Organization (WHO) launched the "Medication Without Harm" initiative to reduce preventable medication-related harm by 50% globally [2]. Despite such efforts, medication toxicity remains a persistent challenge, particularly in low- and middle-income countries where regulatory frameworks and public health literacy are often inadequate [3].

An increasing reliance on self-medication-driven by the widespread availability of over-the-counter (OTC) drugs and online health information-has further compounded this challenge. Numerous studies have highlighted the risks associated with self-treatment, including potential drug interactions, dosing errors and misinterpretation of symptoms, particularly among individuals lacking formal healthcare knowledge [4]. This trend is particularly concerning in settings where pharmacovigilance systems are underdeveloped or underutilized.

In the context of Saudi Arabia, pharmaceutical access has expanded rapidly, accompanied by high rates of antibiotic overuse, poor drug storage practices and limited awareness of medication expiration and toxicity risks [5,6]. For example, Alhur *et al.* [7] observed that many individuals discontinue prescribed medications upon experiencing side effects, often without consulting healthcare professionals. This disconnect between awareness and safe behavior reflects a broader issue of health literacy and behavioral adherence.

Moreover, sociocultural factors-such as reliance on community-based advice and limited engagement with pharmacists-further influence medication-related decisions. Health behaviors are also shaped by demographic factors including age, education and gender. Research has consistently found that younger individuals and those with lower educational attainment are more prone to unsafe medication use [8,9]. However, existing studies in Saudi Arabia have not comprehensively examined how these demographic variables influence awareness and behavior regarding medication toxicity.

This study aims to assess the level of public knowledge, perceived risks and preventive practices related to medication toxicity among the Saudi Arabian population. It also seeks to examine the associations between key demographic factors-such as gender, education level and healthcare experience-and medication safety behaviors.

This paper contributes to the empirical literature by providing nationally relevant data on the behavioral patterns associated with medication use in Saudi Arabia. It addresses a gap in current research by analyzing the demographic determinants of medication safety and offers evidence-based recommendations for targeted public health interventions.

METHODS

Study Design

This research adopted a cross-sectional, observational design to investigate public knowledge, perceived risk factors and preventive practices related to medication toxicity among individuals residing in Saudi Arabia. This design was selected to capture a snapshot of behaviors and perceptions within the population at a single point in time.

Sample Size Estimation and Population

Sample size calculations were performed using Epi Info version 7.2. Based on an anticipated awareness prevalence of 50%, a 95% confidence level and a 5% margin of error, the minimum required sample was determined to be 385 participants. To address the likelihood of incomplete or invalid responses, a 40% oversampling rate was applied, resulting in a target sample size of 540. Ultimately, 543 valid responses were collected and analyzed.

Participants were recruited from the general population using a non-probability convenience sampling technique. Eligibility criteria included being aged 18 years or older, residing in Saudi Arabia and demonstrating sufficient literacy to complete the questionnaire. No incentives were offered for participation.

Data Collection Instrument

Data were gathered using a structured questionnaire developed in accordance with previous research on medication safety and public health behavior. The instrument comprised six sections: (1) demographic information, (2) knowledge and awareness of medication toxicity, (3) perceived risk factors, (4) preventive practices, (5) behavioral responses to adverse drug reactions and (6) storage and safety measures. Items were presented in multiple-choice and Likert-scale formats.

To ensure content validity, the questionnaire was reviewed by experts in pharmacology and public health. A pilot test was conducted with 30 respondents to confirm the clarity, comprehensibility and reliability of the tool. Minor revisions were made based on feedback.

Data Collection Procedure

The questionnaire was administered electronically over a four-week period. The link was distributed via online platforms and social media channels. All participants were required to provide informed electronic consent prior to accessing the survey. Participation was voluntary and responses were anonymized.

Data Analysis

Quantitative data were analyzed using IBM SPSS Statistics version 26. Descriptive statistics-including frequencies, percentages and means-were used to summarize participant characteristics and response patterns. Inferential analysis was conducted using Pearson's chi-square test to examine associations between demographic variables and medication safety-related behaviors. A p-value of less than 0.05 was considered statistically significant.

Ethical Considerations

The study protocol received ethical approval from the Institutional Review Board (IRB) of the University of Hail (Approval No. H-2024-123). All data were collected

anonymously and no personal identifiers were retained. The research was conducted in accordance with the principles outlined in the Declaration of Helsinki and relevant national regulations regarding human subjects research.

RESULTS

Demographic Characteristics

The study included participants from various age groups, with the majority (63.35%, n = 344) being aged 18-29 years, followed by 15.29% (n = 83) aged 30-39, 10.87% (n = 59) aged 40-49, 5.71% (n = 31) aged 50-59 and 3.87% (n = 21) aged 60 and above.

The gender distribution showed a slightly higher representation of females (54.88%, n = 298) compared to males (45.12%, n = 245).

Regarding education level, 57.06% (n = 310) of respondents had a Bachelor's degree, while 22.09% (n = 120) completed secondary school, 16.55% (n = 90) held a Master's degree and 4.30% (n = 24) had a PhD or higher qualification. These demographic details are summarized in Table 1.

A high proportion of respondents (86.21%, n = 468) reported being aware of the term 'medication toxicity', while 13.79% (n = 75) had never heard of it.

Additionally, 40.51% (n = 220) had studied or worked in a healthcare-related field, whereas 59.49% (n = 323) had no such experience (Table 2).

The most commonly cited risk factor for medication toxicity was taking more than the prescribed dose (72.78%, n = 395), followed by mixing medications without professional consultation (51.55%, n = 280). Other risk factors included using expired medications (35.02%, n = 190) and improper storage (26.17%, n = 142) (Table 3).

When asked about medication safety habits, 63.58% (n = 345) of respondents reported always checking the expiry date before use, while 23.78% (n = 129) did so occasionally. However, 8.29% (n = 45) rarely check expiry dates and 4.24% (n = 23) never do.

Regarding consultation habits, 40.51% (n = 220) always consult a healthcare professional before taking new medication, while 39.55% (n = 215) do so occasionally. However, 14.37% (n = 78) rarely and 5.34% (n = 29) never seek professional advice before taking medication (Table 4).

Figure 1 responses to the question: “Have you ever stored medications in a way that increases toxicity risk?” A total of 34.08% of participants answered 'Yes', while 65.92% answered 'No'.

When respondents encountered unexpected symptoms or side effects from medications, their reactions varied significantly. The most common response was immediately stopping the medication, reported by 57.06% (n = 310) of participants. This finding suggests a tendency for individuals to halt medication use rather than seek immediate professional advice.

A large proportion, 36.78% (n = 200), opted to consult a doctor or pharmacist, demonstrating a more cautious and informed approach to managing side effects. However, a small percentage of respondents engaged in potentially risky behaviors, with 4.05% (n = 22) reducing the dose on their own and 1.84% (n = 10) ignoring the symptom altogether (Table 5).

Respondents reported engaging in several preventive practices to minimize the risk of medication toxicity. The most common preventive measure was strictly following prescribed dosages, with 78.43% (n = 425) of participants adhering to their prescribed medication regimens.

Additionally, 62.74% (n = 340) of respondents regularly checked expiry dates before using medications, ensuring that expired drugs were not consumed. Consulting pharmacists before mixing medications was practiced by 57.06% (n = 310), reflecting awareness of the potential risks associated with drug interactions. Moreover, 54.40% (n = 295) reported proper storage of medications, which is crucial in maintaining drug efficacy and preventing toxicity (Table 6).

Table 1: Demographic characteristics

Category	Response	n (%)
Age	18–29	344 (63.3)
	30–39	83 (15.3)
	40–49	59 (10.9)
	50–59	31 (5.7)
	60+	21 (3.9)
Gender	Male	245 (45.1)
	Female	298 (54.9)
Education	Secondary School	120 (22.1)
	Bachelor’s Degree	310 (57.1)
	Master’s Degree	90 (16.6)
	PhD or Higher	24 (4.4)

Table 2: Knowledge and awareness of medication toxicity

Question	Response	n (%)
Worked or studied in healthcare	Yes	220 (40.5)
	No	323 (59.5)
Heard of "medication toxicity"	Yes	468 (86.2)
	No	75 (13.8)

Table 3: Perceived risk factors for medication toxicity

Risk Factor	n (%)
Overdosing beyond prescription	395 (72.8)
Mixing drugs without consultation	280 (51.6)
Using expired medication	190 (35.0)
Improper storage	142 (26.2)

Table 4: Preventive practices and medication safety

Question	Response	n (%)
Check expiry date before use	Always	345 (63.6)
	Occasionally	129 (23.8)
	Rarely	45 (8.3)
	Never	23 (4.2)
Consult professional before new medication	Always	220 (40.5)
	Occasionally	215 (39.6)
	Rarely	78 (14.4)
	Never	29 (5.3)
Stored medication in a risky manner	Yes	185 (34.1)
	No	358 (65.9)

Table 5: Behavior when experiencing side effects

Response	n (%)
Stop medication immediately	310 (57.1)
Consult doctor/pharmacist	200 (36.8)
Reduce dose independently	22 (4.1)
Ignore symptoms	10 (1.8)

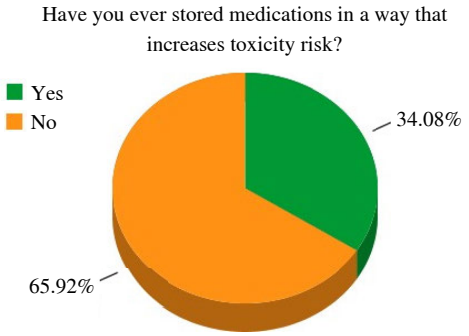

Figure 1: Distribution of participants who reported storing medications in a way that increases toxicity risk

Table 6: Preventive measures taken to reduce medication toxicity

Practice	n (%)
Follow dosage instructions strictly	425 (78.4)
Consult pharmacist before mixing drugs	310 (57.1)
Store medications properly	295 (54.4)
Check expiry dates regularly	340 (62.7)

Table 7: Associations between demographic factors and medication-safety behaviors

Test	Chi-Square value	p-value	Significant at $\alpha = 0.05$
Gender vs. Awareness of Medication Toxicity	543.32	p<0.001	Yes
Education Level vs. Consulting a Healthcare Professional	565.2	p<0.001	Yes
Storage Practices vs. Knowledge of Medication Toxicity	543.86	p<0.001	Yes

The chi-square test results revealed significant associations between gender, education level, consultation habits and medication storage behaviors.

A strong association was found between gender and awareness of medication toxicity ($\chi^2 = 543.32$, $p<0.001$), indicating that awareness levels vary significantly between males and females. This suggests that gender-specific differences may influence how individuals perceive and understand medication risks.

Similarly, education level was significantly associated with consulting a healthcare professional before taking a new medication ($\chi^2 = 565.20$, $p<0.001$). Respondents with higher education levels were more likely to seek professional advice, emphasizing the role of education in promoting safe medication practices.

Furthermore, the results demonstrated a significant relationship between medication storage practices and knowledge of medication toxicity ($\chi^2 = 543.86$, $p<0.001$). Individuals with higher awareness of medication toxicity were less likely to store medications improperly, reinforcing the importance of education in preventing medication-related risks (Table 7).

DISCUSSION

This study investigated public awareness, risk perception and safety-related behaviors regarding medication toxicity among individuals in Saudi Arabia. The findings indicate that although a majority of participants demonstrated familiarity with the concept of medication toxicity, this awareness did not consistently manifest in safe medication practices. Specific behaviors of concern included improper storage of pharmaceuticals, discontinuation of medication without professional guidance and inadequate consultation before initiating new drugs. These practices are widely recognized in the literature as contributors to preventable adverse drug events, including toxicity, drug interactions and avoidable hospitalizations.

These results are broadly consistent with prior studies conducted in Saudi Arabia and elsewhere. For example, Alshammari *et al.* [3] reported significant gaps in public knowledge concerning dosage accuracy, the importance of expiration dates and the risks of polypharmacy-particularly among individuals without formal healthcare education. Similarly, international studies by Ruiz [4] and Hughes *et al.* [5] have emphasized the global prevalence of self-medication, frequently facilitated by easy access to over-the-counter (OTC) products and limited professional oversight.

Although preventive practices such as reading expiry dates and following prescribed regimens are well documented in guidelines, adherence among the study population was inconsistent. This observation aligns with findings by James *et al.* [6], who noted that even individuals with healthcare-related education occasionally resort to self-medication, suggesting that knowledge alone may be insufficient to alter behavior. Therefore, public health initiatives should aim not only to raise awareness but also to foster behavioral change through applied skill development and community reinforcement.

Demographic characteristics were significantly associated with medication safety behaviors. Participants with lower educational attainment and younger age groups were more likely to engage in potentially unsafe practices, such as improper storage or medication discontinuation without consultation. These findings corroborate those of Alhur *et al.* [7] and Alhur *et al.* [8], who identified similar patterns within Saudi and regional populations. Gender also emerged as a significant factor, reflecting broader trends in health-seeking behavior and health literacy.

Self-medication, especially among university-aged individuals, continues to pose challenges in both public and private healthcare settings. While OTC availability may improve accessibility, it also increases the likelihood of unsupervised and inappropriate use. This is especially concerning given the concurrent rise in complex drug regimens, herbal supplements and digital health misinformation.

Recent research in Saudi Arabia has highlighted additional dimensions of medication risk, including the misuse of antibiotics [9,10], potential interactions between pharmaceuticals and herbal or dietary products [11,12] and public perceptions of medication safety in the context of chronic disease management [13]. These findings reinforce the need for a comprehensive, culturally informed approach to medication safety education and regulation.

Although global efforts-such as the World Health Organization's "Medication Without Harm" initiative-have underscored the importance of medication safety [2], the current findings emphasize the necessity of locally adapted strategies. Interventions should incorporate pharmacists, community health workers and digital platforms to deliver targeted educational campaigns, particularly for high-risk groups.

CONCLUSIONS

This study examined public knowledge, perceived risks and behavioral practices related to medication toxicity among the Saudi population. Despite widespread awareness, a substantial proportion of individuals engage in behaviors that increase the risk of adverse drug events, such as improper storage and unsupervised medication cessation. These findings underscore that knowledge, while necessary, is not sufficient to ensure medication safety.

Demographic variables-including age, education level and gender-were significantly associated with medication-related behaviors, highlighting the importance of targeted and context-specific interventions. Policymakers and healthcare stakeholders should prioritize the integration of medication safety education into community health programs, pharmacist consultations and national health campaigns.

To mitigate the public health burden associated with medication toxicity, multi-level strategies are required. These should include regulatory oversight, community-based education and technological tools that empower individuals to make safer, more informed decisions regarding medication use.

Limitations

The study's reliance on self-reported data introduces the potential for response bias and may not fully capture actual behavior. Additionally, the use of convenience sampling limits the generalizability of findings to the broader Saudi population. Future studies should consider longitudinal or mixed-method approaches to explore causal pathways and behavioral motivations in greater depth.

REFERENCES

[1] Kearney, Patricia M. *et al.* "Global burden of hypertension: analysis of worldwide data." *The lancet,* vol. 365, no. 9455, January 2005, pp. 217-223. https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(05)17741-1/abstract.

[2] World Health Organization. *Global burden of preventable medication-related harm in health care: a systematic review* Geneva, Switzerland, World Health Organization, ISBN-17: 978-92-4-008888-7, Pages: 32.

[3] Alshammari, T.M. *et al.* "Medication safety knowledge among Saudi citizens: A cross-sectional study." *Saudi Pharma Journal,* vol 25, no. 1, 2017, pp. 82-87.

[4] Ruiz, Maria E. "Risks of self-medication practices." *Current Drug Safety,* vol. 5, no. 4, October 2025, pp. 315-323. https://www.benthamdirect.com/content/journals/cds/10.2174/157488610792245966.

[5] Hughes, Carmel M. *et al.* "Benefits and risks of self medication." *Drug Safety,* vol. 24, November 2012, pp. 1027-1037. https://link.springer.com/article/10.2165/00002018-200124140-00002.

[6] James, H. *et al.* "Influence of medical training on self-medication by students." *International Journal of Clinical Pharmacology and Therapeutics,* vol. 46, no. 1, 2008, pp. 23-29. https://europepmc.org/article/med/18218294.

[7] Alhur, A.A. *et al.* "Consequences of antibiotic overuse in Saudi Arabia: A multidimensional analysis." *F1000Research*, vol. 14, 2025.

[8] Alhur, Anas *et al.* "Antibiotic misuse in Saudi Arabia: A comprehensive assessment of knowledge, attitudes and practices." *Bahrain Medical Bulletin,* vol. 46, no. 4, 2024.

[9] Alhur, Anas Ali *et al.* "Prevalence and determinants of diabetes in Saudi Arabia: A cross-sectional analysis." *Nigerian Medical Journal,* vol. 65, no. 5, 2024, pp. 569-580. https://www.ajol.info/index.php/nmj/article/view/282567/266240.

[10] Alhur, Anas. "Community insights on drug-herbal interactions: a study from hail, Saudi Arabia." *Cureus,* vol. 16, no. 10, October 2025. https://pubmed.ncbi.nlm.nih.gov/39606543/.

[11] Alhur, Anas *et al.* "A comprehensive review of food-drug interactions: Mechanisms, clinical implications and future perspectives." *Modern Phytomorphology,* vol. 18, no. 4, July 2024, pp. 162-164.

[12] Al-Qahtani, Awad Mohammed *et al.* "Prevalence, perception and practice and attitudes towards self-medication among undergraduate medical students of Najran University, Saudi Arabia: a cross-sectional study." *Risk Management and Healthcare Policy,* vol. 15, February 2025, pp. 257-276. https://www.tandfonline.com/doi/full/10.2147/RMHP.S346998.

[13] Mannasaheb, Basheerahmed Abdulaziz *et al.* "Prevalence, predictors and point of view toward self-medication among residents of riyadh, saudi arabia: a cross-sectional study." *Frontiers in Public Health,* vol. 10, March 2022. https://www.frontiersin.org/articles/10.3389/fpubh.2022.862301/full.